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FISH RESTORATION

Job Performance Report, Project F-73-R-8
Subproject III: Lake and Reservoir Investigations
Study IV: Evaluation of Henrys Lake Management Programs
Job 1: Evaluation of Henrys Lake Trout Stocking Program

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JOB PERFORMANCE REPORT

State of: Idaho

Project No.: F-73-R-8

Subproject No. III

Study No.: IV

Job No.: 1

Name: LAKE AND RESERVOIR INVESTIGATIONS

Title: Evaluation of Henrys Lake Trout Stocking Program

Period Covered: March 1, 1985 to February 28, 1986

ABSTRACT

The trout fishery of Henrys Lake, Idaho, was monitored during the period May 25 to October 31, 1985 as part of a continuing evaluation of management practices. Estimated angler effort decreased by 23% from nearly 163,000 hours in 1984 to about 126,000 hours in 1985. The estimated total catch rate for all trout species was 1.27 fish per hour compared to the management objective of 1.0 fish per hour. Species catch rates of the harvest were 1.17 cutthroat trout (Salmo clarki)/hr., 0.05 hybrid trout (S. clarki x S. gairdneri)/hr., and 0.05 brook trout (Salvelinus fontinalis)/hr. compared to management objectives of 0.65 cutthroat trout/hr., 0.20 hybrid/hr., and 0.15 brook trout/hr.

The mean total length of cutthroat trout measured in the creel in 1985 was 378 mm compared to 388 mm in 1984. No trophy length (510 mm or larger) cutthroat trout were observed during angler interviews. Scale analysis for cutthroat trout In 1985 suggested reduced growth rates. Growth rates of cutthroat trout have probably declined as a direct result of an expansion of the stocking program.

No Canadian strain (Temiscamie and Assinica) brook trout were observed in the 1985 harvest at Henrys Lake.

Approximately 1,000,000 cutthroat trout, 310,000 hybrid trout, and 111,000 Temiscamie strain brook trout were stocked into Henrys Lake in the fall of 1985.

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INTRODUCTION

Henrys Lake is a shallow, eutrophic 2,632 ha system located in East-Central Idaho. The lake currently supports a native population of cutthroat trout (Salmo clarki) Richardson, along with introduced brook trout (Salvelinus fontinalis) and cutthroat x rainbow (S. clarki x Salmo gairdneri) hybrid trout. Henrys Lake has historically been an important fishery in Idaho.

Due to a dramatic increase in angling effort and a concurrent decline in the fishery between the 1950s and 1970s, the Idaho Fish and Game Commission resolved to manage Henrys Lake as a trophy fishery. This plan included specific regulations to restrict harvest which would allow more fish to survive to older ages and reach trophy size before removal from the fishery. Also, the stocking programs for cutthroat trout, brook trout, and hybrid trout were increased. The hatchery program is currently supporting the Henrys Lake fishery. The long-term goal for cutthroat trout is to rely less on supplemental hatchery stockings and more on natural recruitment from tributaries.

The Henrys Lake Enhancement Plan was developed in 1982, and specific goals for the fishery are to increase natural recruitment into the lake by screening irrigation diversions and by improving spawning and rearing habitat in tributary streams. Catch rates to be maintained were 0.7 fish/hr. with 10% of the cutthroat trout and 20% of the hybrid trout exceeding 510 mm total length, and 5% of the brook trout in the harvest exceeding 450 mm. The management plan goal for Henrys Lake was modified in 1985 to 1.0 fish/hr. with catch rates by species to be achieved in the fishery of 0.65 cutthroat trout/hr., 0.20 hybrid trout/hr., and 0.15 brook trout/hr.

This report summarizes fishery research activities conducted at Henrys Lake in 1985 to monitor and evaluate the various programs and management goals implemented by the Idaho Department of Fish and Game.

OBJECTIVES

Describe and compare the performance in survival, growth, and return-to-the-creel of two hatchery stocks and the wild stock of brook trout in Henrys Lake.

Describe the impact of increased stocking levels of cutthroat trout on. relative survival and growth and angler success and harvest in Henrys Lake.

RECOMMENDATIONS

1. Collect zooplankton and benthic macroinvertebrate samples biannually. These organisms are key indicators of secondary production and ecological integrity.

2. Collect water quality data at least biannually.

3. Pinpoint sources of sedimentation and organic enrichment.

4. Monitor the natural recruitment from tributaries of Henrys Lake.

5. Release brook trout and hybrid trout into Hatchery Creek for imprinting purposes. The concern for brook trout is to develop a reliable hatchery brood stock. The concern for hybrid trout is as an added protective measure for the cutthroat trout gene pool.

6. Implement experimental treatment of hybrid trout eggs with methyltestosterone to develop sterility. Compare heat treatment and hormonal treatment success.

7. Monitor the fishery through creel survey and trap netting. Conduct age-growth analysis annually to assess possible growth reductions due to overstocking.

8. Assess the feeding habits of adult cutthroat trout to determine possible predation on stocked fry and fingerlings after fall planting.

TECHNIQUES USED

Hatchery Creek Spawning Run

From March 3 through June 3, 1985, all cutthroat trout and cutthroat x rainbow hybrid trout which entered the fish ladder leading into the Hatchery Creek spawnhouse were counted and then marked on the left (cutthroat trout) or right (hybrid trout) operculum with a paper punch. These marks were utilized to prevent recounting of fish. Prior to being handled and marked, all trout were anesthetized with quinaldine. A random sample of about 10% of all fish was measured to the nearest 5 mm total length. Following artificial spawning, all cutthroat trout were subsequently released back into Henrys Lake via an outflow pipe. The eggtaking operation was terminated when the egg quota was attained.

Sport Fishery

The 1985 creel survey conducted at Henrys Lake was performed using previously described procedures (Coon 1978a; Rohrer 1981) during the period May 25 through October 31. Angler counts were made four times daily by truck or boat on 40% of the weekdays, 50% of the weekend days, and on all holidays during each of the 11 two-week census intervals. Angler interviews and creel checks were conducted randomly as time

permitted. Additionally, angler opinions concerning the Henrys Lake fishery were obtained through a limited number of angler questionnaire interviews.

During angler interviews and creel checks, an effort was made to measure to the nearest 1 mm total length as many harvested trout as possible. Trout were also examined for specific marks. Scale samples from trout were not collected during creel checks.

Population Sampling

Trap Netting

Trap nets were used to sample salmonid populations in select areas of Henrys Lake in September and October 1985 (Fig. 1). Rohrer (1982) and Spateholts (1984) have previously described these nets and their use. All trout captured were examined for marks and measured to the nearest 1 mm total length. Scale samples were collected from cutthroat trout, brook trout, and hybrid trout. Scales were collected from above the lateral line and posterior to the edge of the dorsal fin.

Scale Analysis

Scale samples collected from cutthroat trout during trap netting operations in 1985 were analyzed for age structure of the population and growth comparisons with previously reported information. Scales were also collected from brook trout and hybrid trout captured in nets; however, scale analyses were not performed on these species due to an inadequate size distribution of fish for proper analysis.

Cutthroat trout scales used for analysis (n=128) were selected from the total length distribution of the entire sample which ranged from 110 mm to 491 mm. Ten scale samples, when available, from each 10 mm size class, were analyzed to ensure an equal distribution of all lengths for assessing age structure.

Scales were viewed at 40x magnification using a Micro Design 920 microfiche projector. Dry mounts of 10 to 15 scales per fish were scanned and analyzed. Measurements from scale focus to each annulus observed and to the scale margin were recorded. Body:scale relationships were assessed using linear regression (Zar 1984). Back-calculated total lengths at annuli formation were performed using the direct proportion formula (Fraser 1916; Lee 1920):

$$In - a = \frac{Sn}{S} (I-a)$$

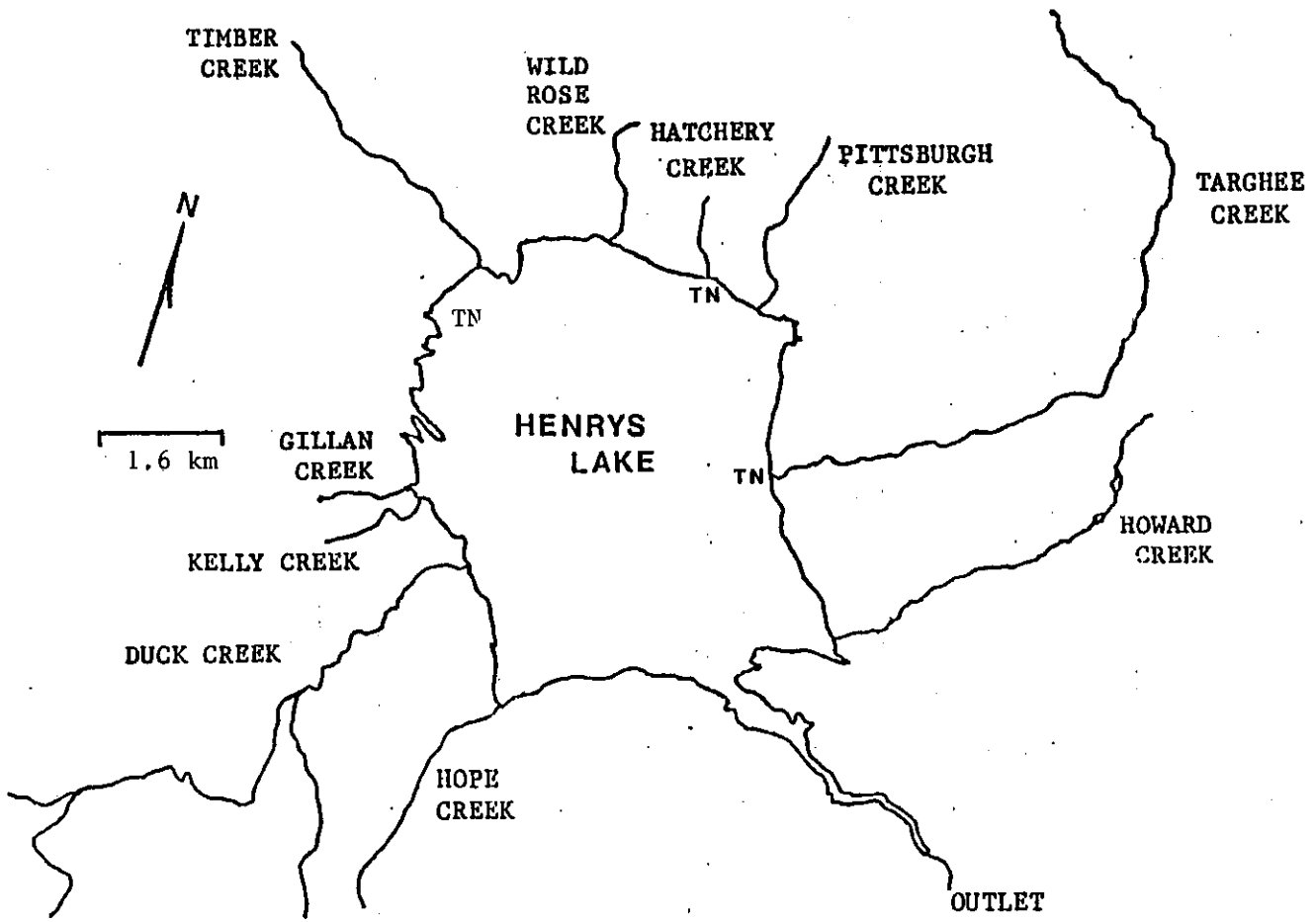

Figure 1. Map of Henrys Lake showing tributaries and areas sampled by trapnetting (TN) in 1985.

where: In = length of fish when annulus n was formed,
I = length of fish when scale sample obtained,
Sn = radius of annulus n,
S = total scale radius, and
a = correction factor (length of fish when scales formed).

The correction factor of 25 mm was used for this analysis (Irving 1953).

Tributary Evaluations

All tributaries of Henrys Lake were not visually inspected as in past years to identify the presence of spawning cutthroat trout and redds. Instead, effort was concentrated on several creeks to locate suitable areas for placement of Kray-Meekin fry traps in late May and early June, 1985. Spawning trout and readily identifiable redds were noted in those streams inspected.

Sections of all tributaries were visually inspected on three separate days in mid-summer (July 22, August 5, August 6) to identify the presence of cutthroat trout fry. Concurrently, the suitability of habitat for rearing Juvenile cutthroat trout was assessed.

Fry Trapping

To assess the relative potential recruitment of cutthroat trout from a small tributary of Henrys Lake, Kray-Meekin fry traps were installed in Kelly Creek and Gillan Creek on June 10 and June 12, respectively. Dimensions of the fry traps were 0.6 m x 0.9 m x 2.1 m. Both traps were placed approximately 100 m above the mouth of the streams and maximum-minimum thermometers were attached to the frame of each trap. Wings were constructed and attached to either side of the traps to channel all streamflow through the apparatus. Traps were inspected once daily and water temperature was recorded. The fry trap placed in Kelly Creek remained in the stream channel from June 10 to September 30, while the trap placed in Gillan Creek was removed on June 25 because of low water conditions. All fish collected were identified, counted, and released.

Stocking Program

In the fall of 1985, a total of 1,003,030 cutthroat trout fry and fingerlings were released in Henrys Lake. Approximately 10.8% of these fry were adipose fin clipped prior to stocking.

Approximately 111,020 Temiscamie strain brook trout fry and fingerlings were released into Henrys Lake in 1985. All brook trout were adipose fin clipped prior to stocking.

The release of cutthroat x rainbow hybrid trout in 1985 totalled 310,383 fingerlings, 10.5% of which were sterile. Normal hybrids (Kamloops, Eagle Lake, McConaughy, and redband strains) were released at the state boat dock, while sterile hybrids (Kamloops and McConaughy strains) were released into the fish ladder at Hatchery Creek. All sterile hybrids were adipose fin clipped prior to release.

Sterile Hybrid Experiments

Experiments to produce sterile cutthroat x rainbow trout hybrids were performed at the Henrys Lake Hatchery on March 11, April 1, and April 15, 1985. Two heat-shock regimes were tested (27 C for 25 minutes at 25 minutes post-fertilization) to compare triploidy success and egg survival using a modified "dip" method versus a recirculating system.

The dip method utilized a 76 liter tub heated by a propane-fueled stove into which a tray containing eggs was immersed, whereas the recirculating system was operated by a constant temperature bath from which heated water was pumped through a Heath stack containing several trays with eggs.

Based on availability, sperm from three strains of rainbow trout (Kamloops, McConaughy, and redband) was used to fertilize cutthroat trout eggs from Henrys Lake stock. Eye-up rates, hatching rates, and percent triploidy success were closely monitored. Triploidy success was assessed at Washington State University.

Benthic Macro invertebrate Sampling

Quantitative benthic invertebrate collections were made at four locations of the Henrys Lake bottom on August 23 using a Ponar grab (Fig. 2). The Ponar grab sampled an area of approximately 0.2 m^2 of substrate. Samples were collected in 1.2 m to 4.6 m of water. Contents of each sample were sieved to separate organisms from debris and then preserved in 95% ethanol. Organisms were identified to order or family.

FINDINGS

Hatchery Creek Spawning Run

From March 3 to June 3, 1985, a total of 5,977 cutthroat trout and 288 hybrid trout entered the fish ladder at Hatchery Creek. Since the ladder was only opened at select intervals to allow a reasonable number of fish into the spawnhouse to be processed and then closed when the statewide egg take requirement was met in mid-May, no total of the 1985

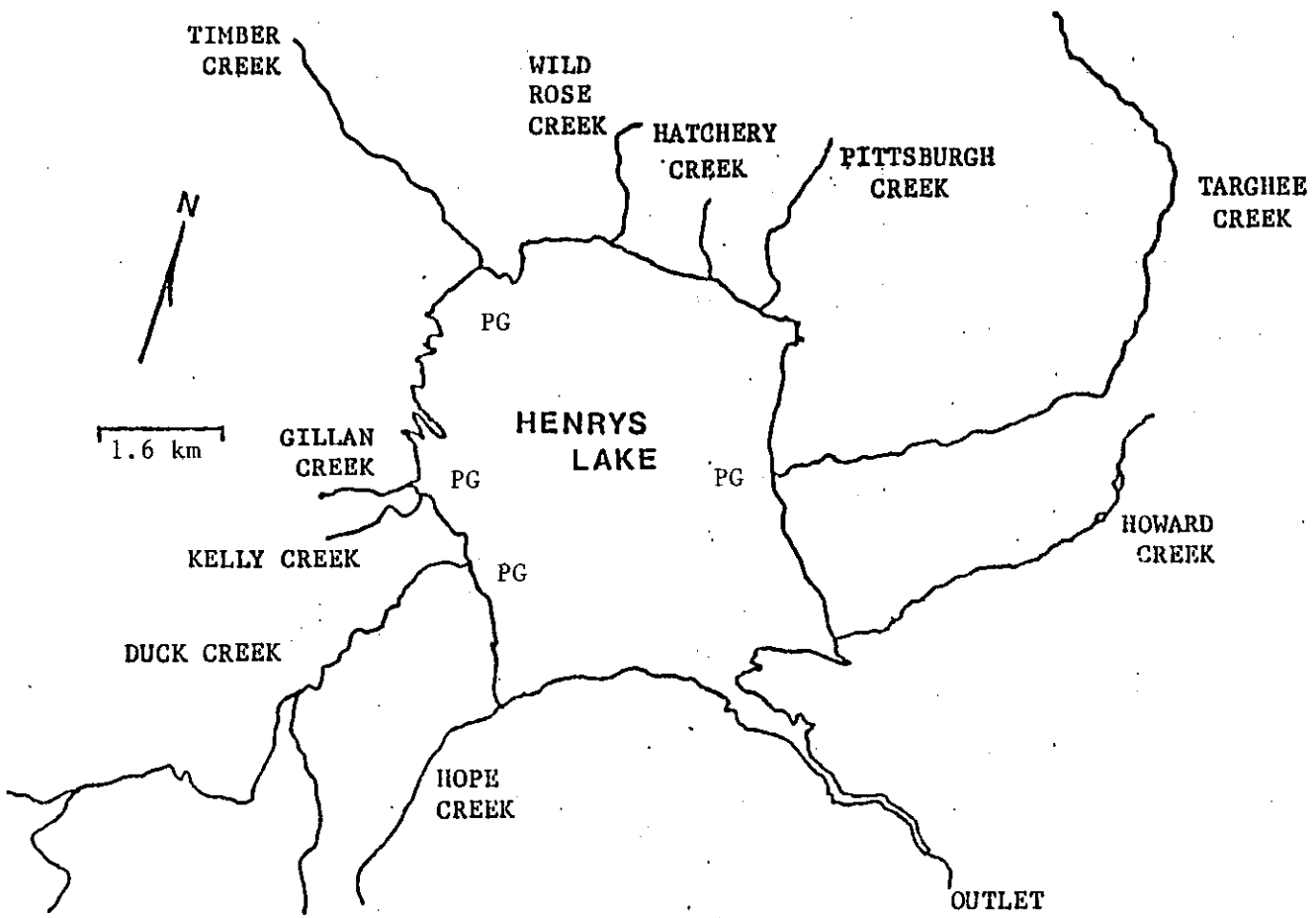

Figure 2. Map of Henrys Lake showing tributaries and approximate locations where the lake bottom was sampled with a Ponar Grab (PG) for the collection of benthic invertebrates, 1985.

spawning run is available. The total spring run was estimated at between 15,000 to 20, 000 fish including those observed congregating in large masses at the mouth of the ladder (Lynn Watson, IDFG, personal communication). This total approximates that observed in the 1984 spring run of spawning trout at Henrys Lake (Greider 1986) (Table 1).

A total of 770 cutthroat trout were measured during the 1985 spring spawning run. Male cutthroat trout (n=347) comprised approximately 45% of the total spawning run and averaged 379 mm (SD=±42 mm) in length with a range from 280 to 500 mm (Fig. 3). Female cutthroat trout (n=423) averaged 377 mm (SD=±56 mm) in length (range 310 mm to 530 mm) (Fig. 4).

Males comprised 83% of the spring run of hybrid trout in 1985. The mean total length of males (n=220) was 354 mm (SD=±45 mm) with a range of 220 mm to 550 mm (Fig. 5). Female hybrid trout (n=45) had an average length of 394 mm (SD=±62 mm) and ranged in size from 300 mm to 660 mm (Fig. 6).

On October 20, 1985, the fish ladder was reopened in preparation for spawning brook trout. Approximately 710 cutthroat trout and 21 hybrid trout ascended the ladder during October and November; however, no brook trout were observed in the fall run.

The total cutthroat trout egg take at Henrys Lake in 1985 amounted to 6,448,418. The eye-up of cutthroat trout eggs (n=5,039,904) was 86% in 1985 as compared to 95% in 1984.

Preserved rainbow trout sperm from four strains was obtained from the Ennis National Fish Hatchery in Montana to fertilize Henrys Lake cutthroat trout eggs. The survival to eye-up of triploid-induced hybrids was 67%, while the average eye-up for normal hybrids was 88%. The Kamloops, McConaughy, and Eagle Lake strains showed promise in developing a viable source of rainbow x cutthroat hybrids. The redband cross exhibited poor results in creating sterile hybrids, showing only 4% eye-up.

Approximately 5.7 million eyed cutthroat trout eggs were shipped to Ashton, Mackay, and McCall hatcheries in 1985, while 400,000 cutthroat trout fry were reared at the Henrys Lake Hatchery. Hybrid trout eggs were transported to Grace Hatchery. About 41, 472 Temiscamie strain brook trout eggs taken in November, 1984, were shipped green to Ashton Hatchery.

Unspawned cutthroat trout were still returning to the fish ladder entering Hatchery Creek well into June after the statewide egg take requirements were met and the spawnhouse operation terminated. Ripe cutthroat trout spawners (n=3,200) were collected from the ladder in late May, transported via truck, and stocked in Targhee Creek approximately 0.4 km above the road culvert on Highway 87.

Table 1. Annual numbers of cutthroat trout and rainbow x cutthroat hybrid trout in the Hatchery Creek spring spawning run at Henrys Lake, 1950-1956 and 1976-1985.

Year	Number of cutthroat trout	Number of hybrid trout
1950	10,000	--
1954	11,577	--
1955	8,804	--
1956	7,651	--
1976	12,190	4[a]
1977	9,628	5[a]
1978	6,600	123[b]
1979	4,625	621
1980	2,774	2,196
1981	2,932	2,315
1982	3,625	923
1983	4,362	438
1984	17,950	720
1985	15,000-20,000[c]	265[d]

[a]Judged naturally produced hybrids.
[b]Estimated 113 of these were first generation fish (92.9% male) planted in 1976.
[c]A rough estimate obtained by observing large mass of spawners in fish ladder and at mouth of Hatchery Creek; approximately 9,177 cutthroat were either spawned or collected and stocked else-where.
[d]Only includes those hybrids actually spawned.

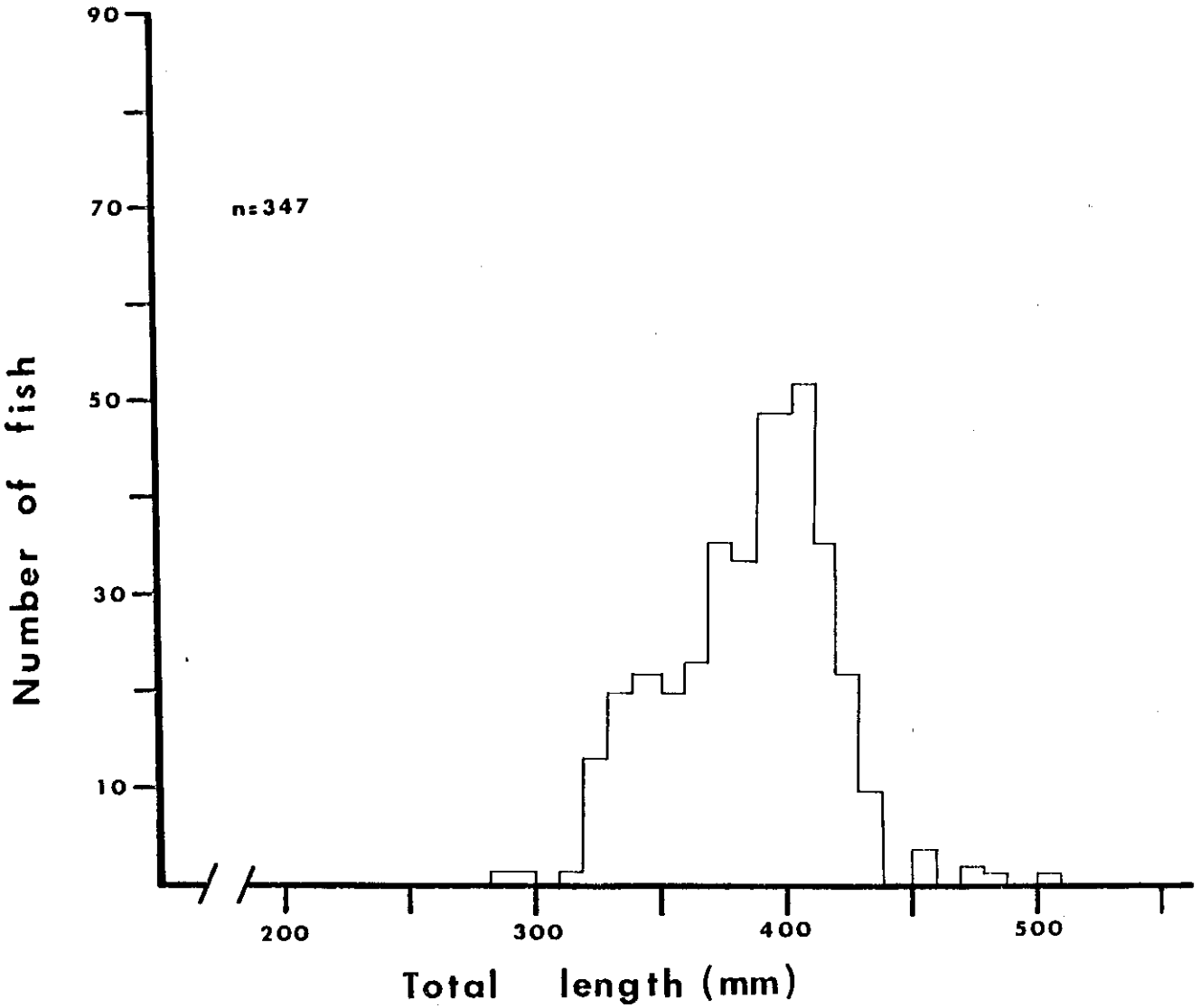

Figure 3. Length-frequency distribution of male cutthroat trout sampled in the 1985 spawning run at the Hatchery Creek spawn house, Henrys Lake.

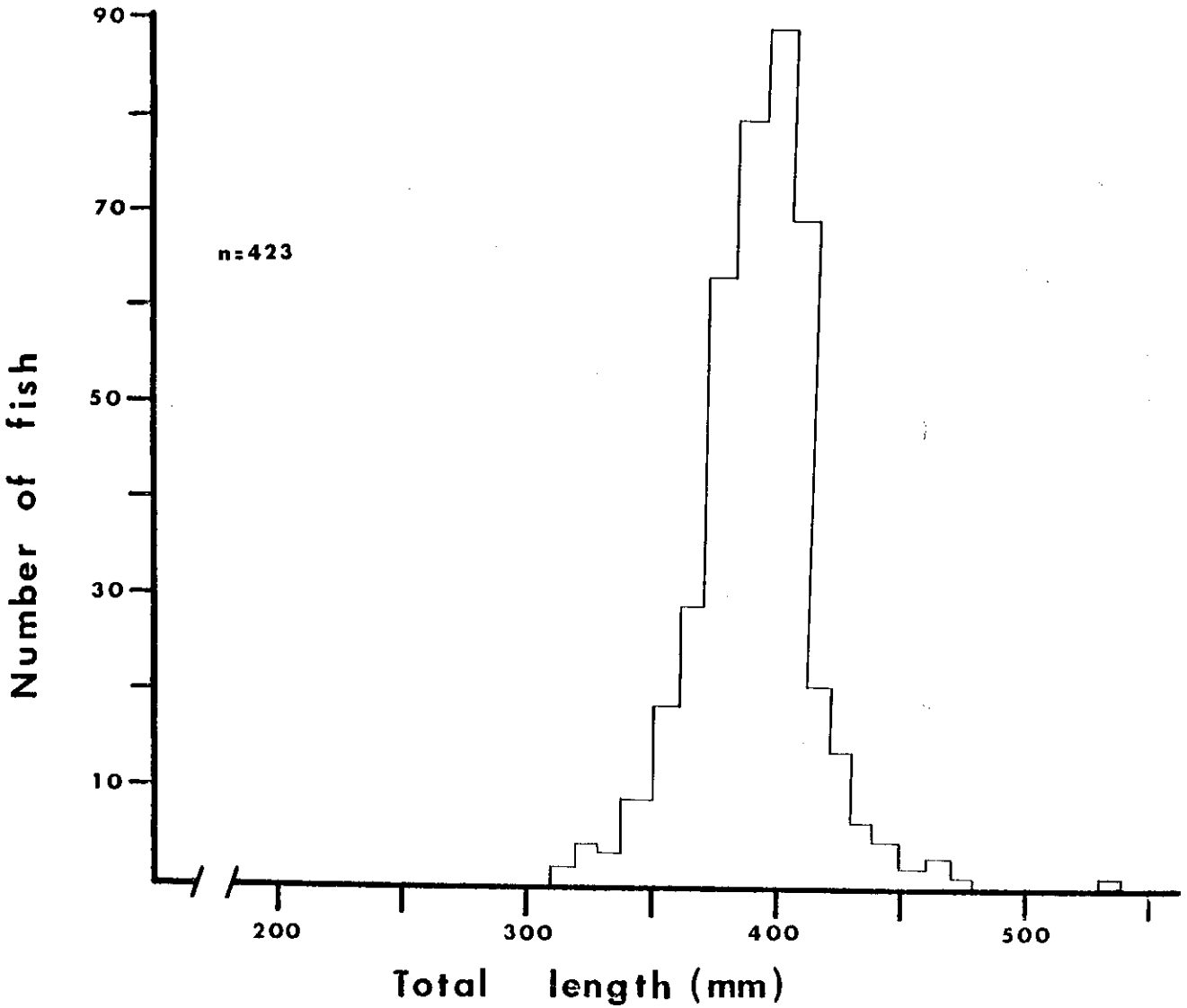

Figure 4. Length-frequency distribution of female cutthroat trout sampled in the 1985 spawning run at the Hatchery Creek spawn house, Henrys Lake.

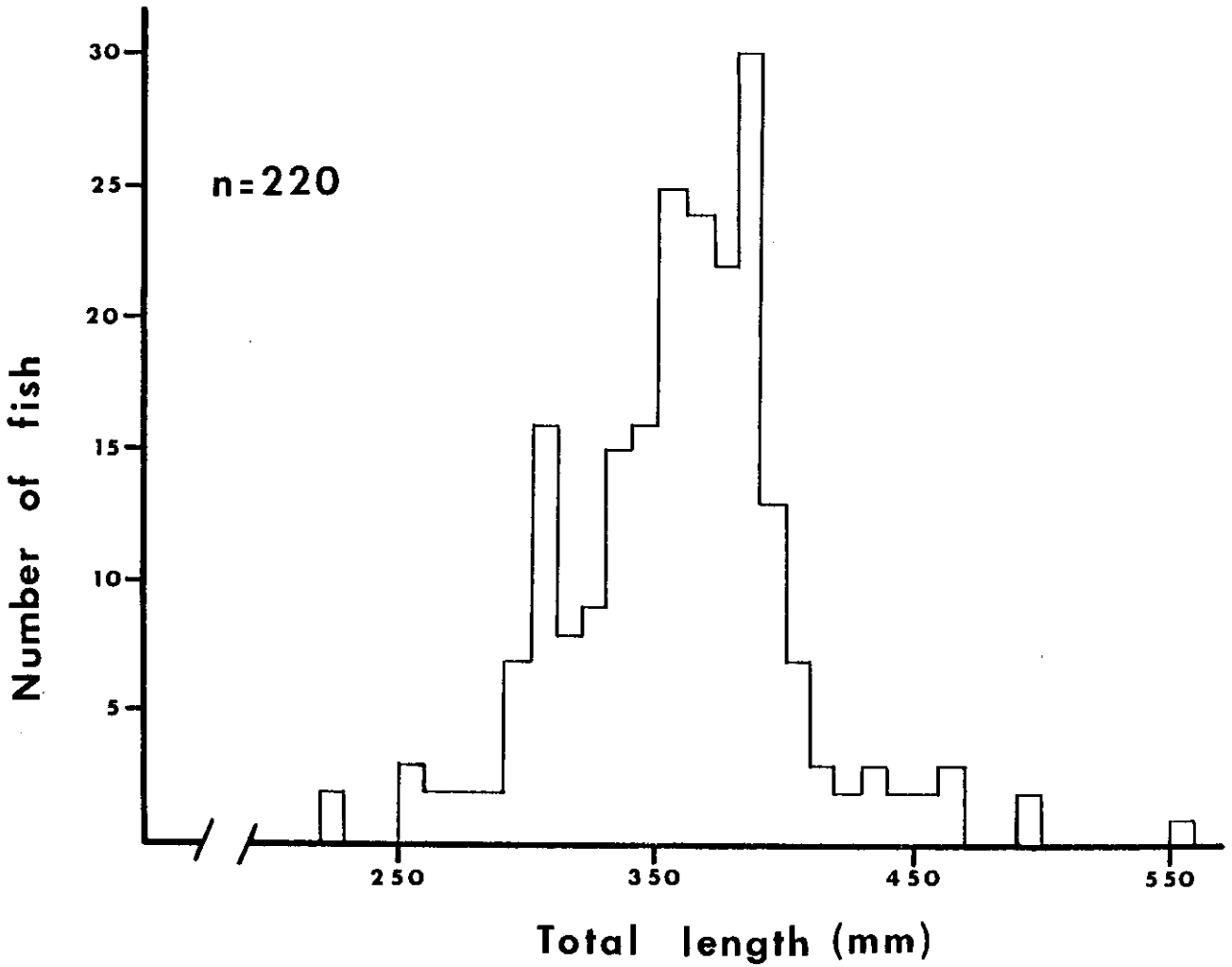

Figure 5. Length-frequency distribution of male hybrid trout sampled in the 1985 spawning run at the Hatchery Creek spawn house, Henrys Lake.

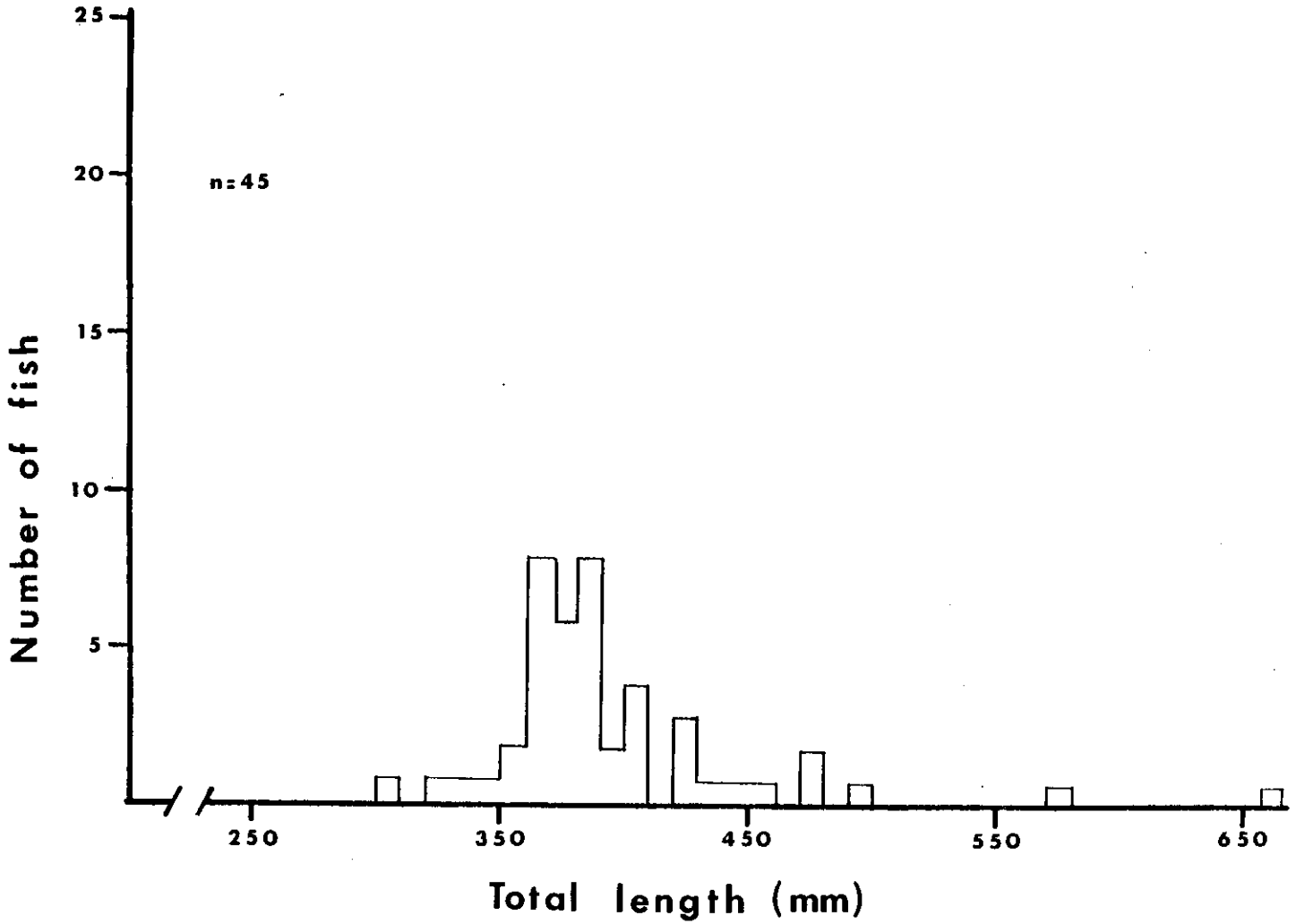

Figure 6. Length-frequency distribution of female hybrid trout sampled in the 1985 spawning run at the Hatchery Creek spawn house, Henrys Lake.

Sport Fishery

Angling Effort and Catch Rate

Anglers expended an estimated 126,000 hours of effort at Henrys Lake during the 1985 fishing season (Table 2). This represented a 23% decline in overall angler hours from the 1984 season (Greider 1986). Nearly 64% of the total angling effort occurred during the first third of the season. The two-week interval that included the Independence Day holiday had the greatest estimated number of hours fished.

The estimated total catch rate was 1.27 trout per hour during the 1985 fishing season at Henrys Lake (Table 2). The 1985 catch rate was 23% lower than reported for 1984, but still represents a dramatic increase in catch rates observed from 1976 through 1982 (Table 4). Boat and float tube anglers enjoyed the greatest success at catching trout (Appendices 1 and 2).

Catch rates for cutthroat trout per interval were consistently greater than the 0.45 fish/hr. specified in the Henrys Lake Enhancement Plan (Table 3), while the catch rate for cutthroat trout in 1985 was nearly twice the catch rate goal. Catch rates for both brook trout and hybrid trout were lower than the specified goals of 0.10 fish/hr. and 0.15 fish/hr., respectively (Table 3).

Trout Harvest Results

Anglers harvested an estimated total of nearly 38,000 trout from Henrys Lake in 1985, while over three times that many trout were released (Table 2). In 1985, total trout creeled represented a 19% decrease and the total number released represented a 46% decrease from 1984 estimates (Table 4). Cutthroat trout comprised 92% of the total trout harvest, while both brook trout and hybrid trout each comprised 4% of the total trout harvest (Table 5). There was an 18% decrease in the estimated number of cutthroat trout (n=34,943), a 3% decrease in the estimated number of brook trout (n=1,423), and a 36% decrease in the estimated number of hybrids (n=1,593) harvested in 1985 as compared to 1984 estimates (Table 5).

The mean total length of cutthroat trout measured during the 1985 creel survey interviews was 378 mm (n=432) (Table 6), which is lower than the 1984 mean size of 388 mm (Table 7). Cutthroat trout ranged in length from 280 mm to 484 mm. The estimated number of cutthroat trout greater than 510 mm total length (trophy criterion) harvested in 1985 was zero (Table 8). In 1984, only 0.5% of the harvested cutthroat trout were estimated to be of trophy status.

The mean total length of brook trout measured in the 1985 creel sample was 364 mm (n=24) (Table 6), which is approximately 29 mm smaller than the average size observed in 1984 (Table 7). Brook trout

Table 2. Estimated total fishing effort, harvest, and catch rates at Henrys Lake, 1985.

Interval	Angler hours	Trout harvested			Total	Trout released	Total trout/hr
		Cutthroat	Brook	Hybrid			
05/25-06/07	12,716	3,990	122	128	4,240	11,118	1.20
06/08-06/21	19,278	7,599	206	108	7,913	32,385	2.09
06/22-07/05	25,240	5,968	0	794	6,762	11,069	0.70
07/06-07/19	23,485	6,258	414	206	6,878	6,947	0.58
07/20-08/02	6,016	871	20	102	993	4,306	0.88
08/03-08/16	5,785	524	0	0	524	13,527	2.42
08/17-08/30	7,462	1,173	458	38	1,669	8,070	1.30
08/31-09/13	7,874	2,486	0	0	2,486	9,699	1.54
09/14-09/27	9,102	1,757	157	157	2,071	18,477	2.26
09/28-10/11	2,900	1,529	0	48	1,577	3,417	1.72
10/12-10/31	5,808	2,788	46	12	2,846	2,414	0.90
Totals	125,666	34,943	1,423	1,593	37,959	121,429	1.27

Table 3. Catch rate (fish/hr.) per species as estimated from creel census data per two-week interval at Henrys Lake, 1985.

Census interval	Catch rate (fish/hr.)			Total
	Cutthroat	Brook	Hybrid	
05/25-06/07	1.11	0.02	0.04	1.20
06/08-06/21	2.00	0.04	0.02	2.09
06/22-07/05	0.62	0.00	0.08	0.70
07/06-07/19	0.53	0.04	0.01	0.58
07/20-08/02	0.77	0.02	0.09	0.88
08/03-08/16	2.42	0.00	0.00	2.42
08/17-08/30	1.12	0.44	0.00	1.56
08/31-09/13	1.54	0.00	0.00	1.54
09/14-09/27	1.90	0.18	0.18	2.26
09/28-10/11	1.67	0.00	0.05	1.72
10/12-10/31	0.88	0.02	0.004	0.90
Totals	1.17	0.05	0.05	1.27

Table 4. Estimated total angler effort, harvest, and catch rates at Henrys Lake, 1976 through 1985.

Year	Angler hours	Trout harvested	Trout released	Total trout/hr.
1976	68,109	18,650	17,997	0.54
1977	66,369	16,474	12,693	0.44
1978	85,304	25,510	15,019	0.48
1979	93,921	18,754	10,997	0.32
1980	68,446	9,262	5,335	0.21
1981	65,918	7,504	6,650	0.21
1982	63,273	7,082	21,610	0.45
1983	95,996	25,453	96,520	1.27
1984	162,878	46,816	224,169	1.66
1985	125,666	37,959	121,429	1.27

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Table 5. Species composition of trout harvested from Henrys Lake, 1976 through 1985.

	Cutthroat		Hybrid		Brook	
Year	Numbe	Percent	Numbe	Percent	Number	Percent
1976	15,119	81.1	20	0.1	3,511	18.8
1977	11,702	71.1	65	0.4	4,699	28.5
1978	12,131	47.5	5,002	19.7	8,377	32.8
1979	6,492	34.6	7,774	41.5	4,462	23.8
1980	2,910	31.4	5,441	58.7	911	9.8
1981	2,283	30.4	4,033	53.7	1,198	15.8
1982	4,346	61.4	1,784	25.2	941	13.3
1983	21,380	84.0	2,356	9.3	1,710	6.7
1984	42,868	91.6	2,488	5.3	1,460	3.1
1985	34,943	92.1	1,593	4.1	1,423	3.8

Table 6. Mean (x) maximum total length of cutthroat, hybrid, and brook trout harvested from Henrys Lake, 1985.

	x maximum total length					
	Cutthroat		Brook		Hybrid	
interval	mm	(n)	mm	(n)	mm	(n)
05/25-06/07	366	(16)	450	(1)	--	--
06/08-06/21	377	(212)	368	(9)	408	(7)
06/22-07/05	375	(26)	--	--	399	(4)
07/06-07/19	373	(113)	349	(8)	460	(4)
07/20-08/02	382	(31)	314	(2)	458	(7)
08/03-08/16	--	--	--	--	--	--
08/17-08/30	386	(13)	356	(4)	403	(1)
08/31-09/13	409	(12)	--	--	--	--
09/14-09/27	--	--	--	--	--	--
09/28-10/11	--	--	--	--	--	--
10/12-10/31	393	(9)	--	--	533	(1)
Totals[a]	378	(432)	364	(24)	416	(24)

[a]Weighted by the estimated harvest during each interval.

Table 7. Mean (x) maximum total length of cutthroat, hybrid, and brook trout harvested from Henrys Lake, 1976-1985.

Year	x maximum total length (mm)		
	Cutthroat trout	Hybrid trout	Brook trout
1976	426	NA[a]	371
1977	420	339	362
1978	429	389	381
1979	452	456	378
1980	429	459	391
1981	445	450	389
1982	416	451	405
1983	388	448	392
1984	388	427	393
1985	378	416	364

[a]Not available, first year of resuming stocking of hybrid trout in Henrys Lake.

Table 8. Estimated number of cutthroat trout exceeding 510 mm maximum total length harvested from Henrys Lake, 1976 through 1985.

Year	Sampl size	Number >510	Percent	Estimated harvest	Estimated total >510 mm
1976	1,087	20	1.8	15,119	272
1977	1,613	62	3.8	11,702	445
1978	1,182	111	9.4	12,131	1,140
1979	636	69	10.8	6,492	701
1980	403	44	10.9	2,910	317
1981	106	14	13.2	2,259	298
1982	218	15	6.9	4,436	300
1983	751	19	2.5	21,380	534
1984	645	3	0.5	42,868	214
1985	432	0	0.0	34,943	0

measured in the creel ranged in size from 271 mm to 450 mm with none of the fish estimated to have reached the trophy criterion (>450 mm) (Table 9). No marked brook trout were observed in creel checks in 1985 as compared with nearly 30% marked fish in 1984 creel checks.

The mean total length of hybrid trout sampled by creel checks in 1985 was 416 mm (n=24) (Table 6). This is smaller than the mean size of 427 mm reported in 1984 (Table 7). Hybrid trout measured in the creel ranged in size from 381 mm to 546 mm. None of the hybrid trout measured in 1985 creel checks reached the trophy size designation (>550 mm), as compared to 5.4% of the estimated hybrid harvest in 1984 (Table 10).

Angler Profiles and Attitudes

Resident anglers comprised about 60% of the total effort in 1985 at Henrys Lake (Table 11) compared to 64% in 1984. Resident effort was greatest during the early and late intervals of the season.

The angler profile at Henrys Lake in 1985 followed a trend similar to past years (Table 11). The majority of anglers (79%) fished from boats (Appendix A), while 12% fished from the bank (Appendix B), and 9% used float tubes (Appendix C). Trolling was popular early and late in the fishing season, as was casting from either boats or the bank.

Seventy-four percent of anglers interviewed believed fishing was either good or excellent at Henrys Lake (Table 12). The 20% who categorized fishing as fair or poor did so primarily during the summer months. Over one-fourth of the anglers questioned preferred to see more larger fish. The vast majority of anglers were in favor of the current two fish limit (Table 12).

Population Sampling

Trap Netting

During the fall of 1985, a total of 623 trout were captured in trap nets which were set at three different locations for eight net nights. Cutthroat trout comprised 82% of the total and averaged 64 fish per net night, brook trout comprised 17% of the sample and averaged 13 fish per net night, and hybrid trout comprised 1% of the sample and averaged 0.8 fish per net night. No nongame fish species were collected.

The mean size of cutthroat trout captured in trap nets (n=504) was 394 mm (SD=±32 mm). The mean size of brook trout (n=108) and hybrid trout (n=26) captured in trap nets was 362 mm (SD=±53 mm) and 394 mm (SD=±88 mm), respectively. Cutthroat trout ranged in size from 110 mm to 531 mm, brook trout from 107 mm to 495 mm, and hybrid trout from 106 mm to 489 mm.

Table 9. Estimated number of brook trout exceeding 450 mm maximum total length harvested from Henrys Lake, 1979 through 1985.

Year	Sample size	Number >450	Percent	Estimated harvest	Estimated total >450 mm
1979	329	20	6.1	4,462	272
1980	125	6	4.8	911	44
1981	52	10	19.2	1,188	228
1982	59	15	25.4	941	239
1983	98	17	17.3	1,710	296
1984	45	6	13.3	1,460	194
1985	24	0	0.0	1,423	0

Table 10. Estimated number of hybrid trout exceeding 550 mm maximum total length harvested from Henrys Lake, 1979 through 1985.

Year	Sample size	Number >550	Percent	Estimated harvest	Estimated total >550 mm
1979	779	60	7.7	7,774	599
1980	750	120	16.0	5,441	870
1981	239	27	11.3	4,033	456
1982	99	17	17.2	1,784	307
1983	95	13	13.7	2,356	323
1984	55	3	5.4	2,488	134
1985	24	0	0.0	1,593	0

Table 11. Estimated angler profile and percent of hours at Henrys Lake, 1985.

Census interval	Resident	Fishing from			Trolling			Casting		
		Boat	Bank	Tube	Bait	Lures	Flies	Bait	Lures	Flies
05/25-06/07	67	67	28	5	16	81	3	54	31	15
06/08-06/21	65	90	3	7	4	95	1	28	40	32
06/22-07/05	65	78	11	11	13	77	10	43	7	50
07/06-07/19	62	87	5	8	0	100	0	38	40	22
07/20-08/02	64	84	13	3	82	18	0	38	25	37
08/03-08/16	44	56	28	16	0	100	0	13	31	56
08/17-08/30	37	75	15	10	25	50	25	14	16	70
08/31-09/13	56	78	<1	22	0	60	40	23	0	77
09/14-09/27	22	87	<1	13	0	100	0	0	58	42
09/28-10/11	79	55	36	9	0	100	0	48	33	19
10/12-10/31	96	58	41	1	22	75	3	82	10	8
TOTALS[a]	60	79	12	9	11	82	7	35	27	38

[a]Weighted by angler hours for each interval.

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Table 12. Responses of anglers to questions asked during creel checks at Henrys Lake, 1985.

1. How would you rate fishing at Henrys Lake? (n=134)

Excellent	30%
Good	44%
Fair	18%
Poor	8%

2. What suggestions would you make to improve fishing? (n=134)

Expanded limit	21%
No bait	2%
Catch-and-release	3%
Barbless hooks	4%
Minimum size	3%
Larger fish	26%
Unchanged	30%
Others	11%

3. Are you in favor of the current daily possession limit of two fish or should it be increased to three? (n=130)

Two	65%
Three	35%

Of the brook trout captured in trap nets, unmarked fish (n=59) comprised 54% of the sample and had a mean total length of 344 mm (SD=±50 mm). The Temiscamie strain (adipose fin clipped brook trout) stocked in 1982 comprised about 38% of the sample (n=41) and averaged 388 mm (SD=±51 mm) in length. Some of these fish may have been the 1980 plant of the domestic Ford stock from Sandpoint Hatchery. Distinction between these stocks was not possible due to the lack of differing physical characteristics. Approximately 5% of the brook trout sampled were comprised of the Assinica strain (left ventral fin clip) stocked in 1980. The mean total length of Assinica strain brook trout was 350 mm (n=5) (SD=±34 mm). About 3% of the brook trout sample was comprised of either the 1980 plant of domestic Ford Hatchery stock or the Temiscamie strain plant of 1981. These groups of fish received a right ventral clip, and in the 1985 sample, averaged 378 mm in length (n=3).

Scale Analysis

Scale analysis for cutthroat trout sampled from Henrys Lake in 1985 indicated exceptional growth (Table 13). The coefficient of determination using linear regression was 0.40.

Back-calculated total lengths are greater for the 1985 scale analysis of Henrys Lake cutthroat trout than the majority of those cited In Carlander (1969) for cutthroat trout in other water bodies. However, the back-calculated total lengths of fish sampled from Henrys Lake in 1985 are substantially less than those reported by Irving (1953), Coon (1978b), and Cole (1984) (Table 14). Mean back-calculated lengths were similar for fish sampled in 1984 (Greider 1986), except for the third annulus. Henrys Lake cutthroat trout exhibit average annual growth increments in total length approaching 100 mm or more throughout their lifespan (Table 13).

Very few I+ fish and no four- or five-year-old cutthroat trout were sampled from Henrys Lake in 1985; thus, all age-growth analysis was essentially performed on two- and three-year-old fish.

Tributary Evaluations

Spawning Activity

Howard Creek Slouqh: On May 21, 21 cutthroat trout redds were observed in Howard Creek Slough from the mouth to the first north-south fenceline. Adult cutthroat trout were observed holding in pools and near undercut banks in the proximity of observable redds.

Table 13. Mean back-calculated total length (mm) at annuli formation of cutthroat trout sampled from Henrys Lake in 1985 (a=25 mm). Standard deviations are given in parentheses.

Year class	I	II	III	Mean length at capture
1984	72(13)			202 (2)
1983	105(15)	234(25)		358(24)
1982	102(10)	234(20)	350(22)	425(28)
No. of fish	2	51	75	
Weighted mean length	102	234	350	
Mean increment of growth	102	130	115	
Standard deviation of length at age	13	22	22	

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Table 14. Comparison of mean back-calculated total length (mm) at annuli formation of cutthroat trout sampled from Henrys Lake In 1950-1951 (Irving 1953), 1977 (Coon 1978b), 1983 (Cole 1984), 1984 (Greider 1986), and 1985.

Year sampled	Sample size	Back-calculated total length at annulus				
		I	II	III	IV	V
1950-51	363	132	292	417	500	533
1977	32	148	295	409	466	533
1983	56	121	260	332	415	--
1984	115	104	213	292	401	--
1985	128	102	234	350	--	--

Kelly Creek: On May 23, 324 cutthroat trout redds were visible in Kelly Creek from the mouth and upstream a distance of approximately 0.8 km. About 600 adult cutthroat trout were present in this stream length. Redds appeared to overlap in many instances, possibly resulting in an underestimate.

Gillan Creek: Numerous redds were seen in Gillan Creek on May 23, but overlap made an approximate count futile. Very few adult fish were seen while walking adjacent to the stream.

South Fork Duck Creek: On June 10, the South Fork of Duck Creek from its confluence with Duck Creek proper to a large beaver dam complex was visually inspected. No fish were seen. Numerous barriers to movement such as a 5-6 m long road culvert and debris dams were present.

Fry Observations

Duck Creek: On August 6, several cutthroat trout fry were observed in Duck Creek below the road culvert located near the junction of the Red Rock Pass Road and the Duck Creek Road. Water temperature was 10.5 C.

Hope Creek: On August 6, several cutthroat trout fry were observed while walking the Magelby property near the Duck Creek Road. Flows were extremely low at this time. Water temperature was 9 C.

Howard Creek: On August 5, several cutthroat trout fry were seen above the Highway 87 culvert when water temperature was 7 C.

Howard Creek Slough: On August 5, numerous cutthroat trout fry and brook trout juveniles were seen in Howard Creek Slough. Water temperature was 8 C.

Pittsburgh Creek: On August 5, several cutthroat trout fry were observed near the mouth of Pittsburgh Creek. No fry were seen in the creek proper; however, a direct view of the stream channel generally was obscured by dense riparian vegetation. Water temperature was 9.5 C.

Targhee Creek: Several cutthroat trout fry and brook trout fingerlings were observed in Targhee Creek below the Highway 87 road culvert on August 5. No fry were seen above the road culvert.

Timber Creek: On August 6, several cutthroat trout fry were seen in Timber Creek above the mouth. Spawning activity was reported as having been exceptional in the spring (O.A. Thomas, homeowner near Henrys Lake, personal communication). Water temperature was 11.5 C.

Wild Rose Creek: Many cutthroat trout fry were observed at the mouth of Wild Rose Creek on August 5, and several were seen in the creek up to the Highway 87 road culvert. No fry were observed above the road culvert. Water temperature was 9 C.

Fry Trapping

A total of 1,009 cutthroat trout fry, 34 brook trout juveniles, 3 rainbow x cutthroat trout hybrid juveniles, 12 mottled sculpin (Cottus bairdi), and 2 longnose dace (Rhinichthys cataractae) were collected during the three and one-half month period that a Kray-Meekin fry trap was set in Kelly Creek. The first cutthroat trout fry appeared in the trap on June 21 (Fig. 7). Numbers of fry peaked at 167 fish on July 23. The greatest movement occurred during the period July 23 to August 13 when 82% of the total number of fry were captured.

Diel water temperatures ranged generally from 7 to 15 C during peak movement of fry. Ambient water temperatures in Kelly Creek during the period June 10 to September 30 ranged from a low of 0 C on September 30 to 20 C on June 14.

Stocking Program

Cutthroat trout fingerlings reared at the Ashton and Mackay hatcheries were released in Duck, Howard, Targhee, and Timber creeks, and at the Hatchery Creek fish ladder on September 23 to 25 (Table 15).

The cutthroat x rainbow trout hybrids reared at the Grace Hatchery were released at the state boat dock (normal) and at the Hatchery Creek fish ladder (sterile)(Table 15).

Brook trout eggs were received from Cornell University, New York, in 1984. Consequently, these Temiscamie strain fish were stocked into the Hatchery Creek fish ladder in the fall of 1985 (Table 15). Also, the spawntake from the fall of 1984 resulted in about 27,000 fingerling brook trout which additionally were stocked in the fish ladder.

Sterile Hybrid Experiments

Sterile hybrid trout (cutthroat x rainbow) experiments conducted at the Henrys Lake Hatchery in 1985 again exhibited promising results. Experiments performed with the McConaughy strain cross resulted in the best survival to eye-up, to hatching, and to the fingerling stage (Table 16). Chromosome analysis of this cross showed 85% (13 of 15 eyed eggs) to be triploid (G. Thorgaard, Washington State University, personal communication). The redband strain cross faired poorly in 1985 testing.

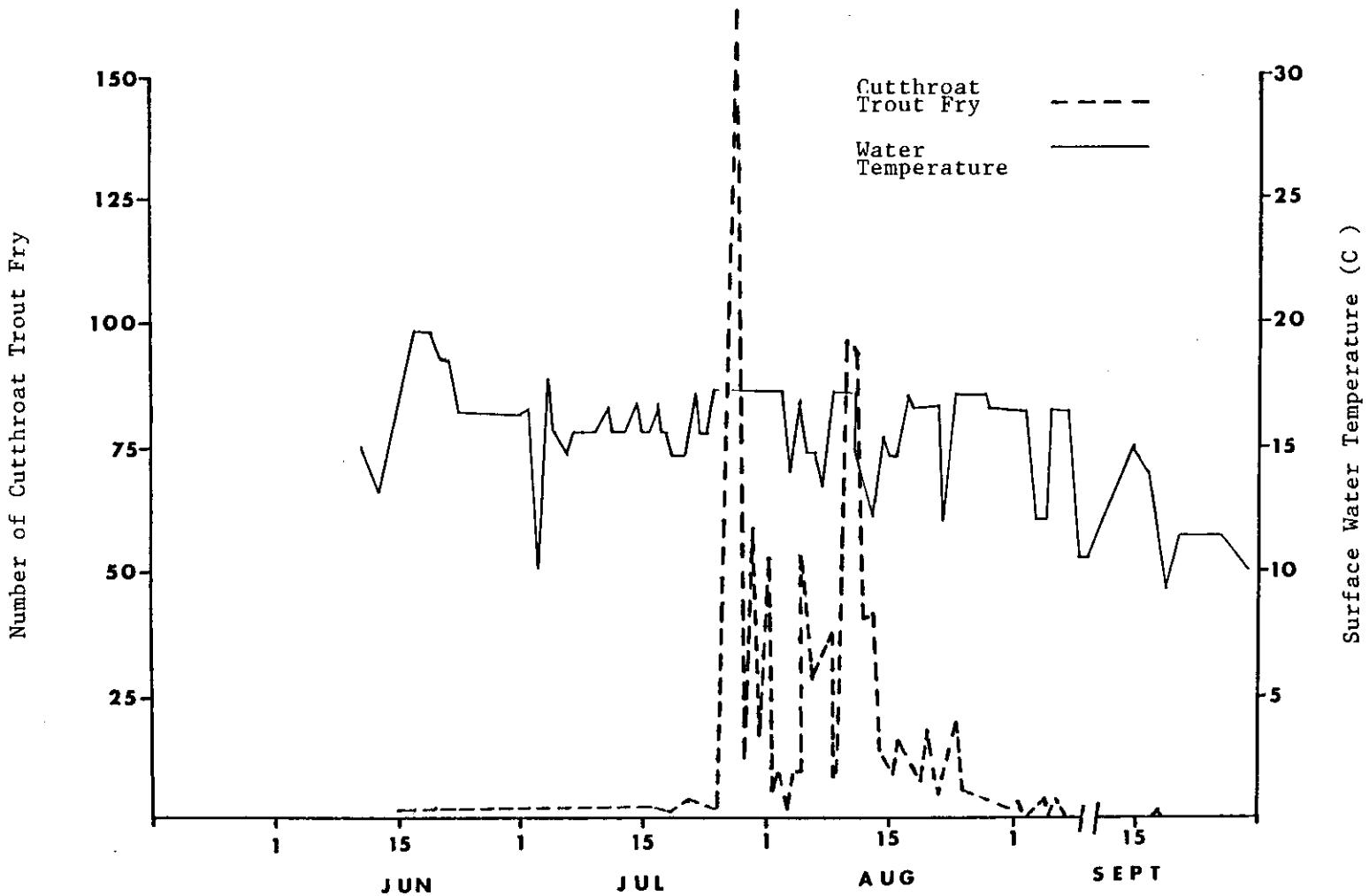


Figure 7. The number of cutthroat trout fry collected daily in a Kray Meekin fry trap set in Kelly Creek from June 10 to September 30, 1985.

Table 15. Summary of 1985 stocking program at Henrys Lake.

Date	Location	Kg stocked		No./kg	Totals
		250.00		192.72	
CUTTHROAT					
TROUT	Fish ladder				48,180
	Timber Creek	227.27		211.42	48,050
	Duck Creek	454.54		211.42	96,100
	Targhee Creek	227.27		281.60	64,000
24 Sept	Fish ladder	272.72		286.00	78,000
	Timber Creek	181.82		341.00	62,000
	Targhee Creek	181.82		341.00	62,000
		45.45		286.00	13,000
	Howard Creek	363.64		281.60	102,400
25 Sept	Fish ladder	227.27		686.40	156,000
		227.27		193.60	44,000
	Targhee Creek	272.72		281.60	76,800
TOTAL		2,931.79		3,594.36	1,003,030[a]
		147.72		184.80	
BROOK TROUT - Temiscamie strain					
	Fish ladder				27,300
		514.00		162.80	83,720
TOTAL		661.72		347.60	111,020[b]
		317.27		399.96	
HYBRID TROUT					
Normal Type					
	State dock		(KAM)[c]		126,890
		116.64	(KAM)[c]	298.10	33,875
		193.20	(EAG)[d]	345.40	66,725
		107.04	(McC)[e]	365.20	39,093
		17.04	(RED)[f]	660.00	11,250
TOTAL		751.19		2,068.66	277,833
Sterile Type				231.00	
	State dock	140.90 (KAM+ McC)			32,5509
TOTAL					310,383

[a]106,800 (10.8%) received adipose clips.
[b]All received adipose clips.
[c]Kamloops strain of rainbow trout.
[d]Eagle strain of rainbow trout.
[e]McConaughy strain of rainbow trout.
[f]Redband strain of rainbow trout.
[9]Sterile hybrids received adipose clips.

Table 16. Results of sterile hybrid experiments conducted at the Henrys Lake Hatchery, 1985.

Date	Method	Cross	Group	% to eye-up	% to hatching	% to fingerling	% triploidy
3 Mar	Dip	Kamloops	Heat	61	50	21	80 (16/20)
			Control	88	84	79	0
1 Apr	Recirc	McConaughy	Heat	73	62	37	87 (13/15)
			Control	86	81	75	0
15 Apr	Recirc	Redband	Heat	6	4	NA[a]	NA[a]
			Control	78	25	21	0

[a]Not analyzed.

The recirculating system technique showed somewhat better success than the modified "dip" method.

Benthic Macroinvertebrate Sampling

Amphipods (freshwater shrimp) comprised the majority of benthic macroinvertebrates collected in August from Henrys Lake making up from 64% to 89% of total numbers of the samples (Figs. 8 to 11). Chironomid (midges) larvae were the second most abundant taxon present in benthic samples.

Densities of benthic invertebrates were greatest at the mouth of Duck Creek where nearly 2,600 organisms/m^2 were present (Fig. 9). Invertebrates declined in abundance at the Schoolhouse Canyon site, the mouth of Targhee Creek, and the Staley Springs Harbor site, respectively. All benthic samples contained the aquatic macrophytes Chara sp. and Elodea sp.

DISCUSSION

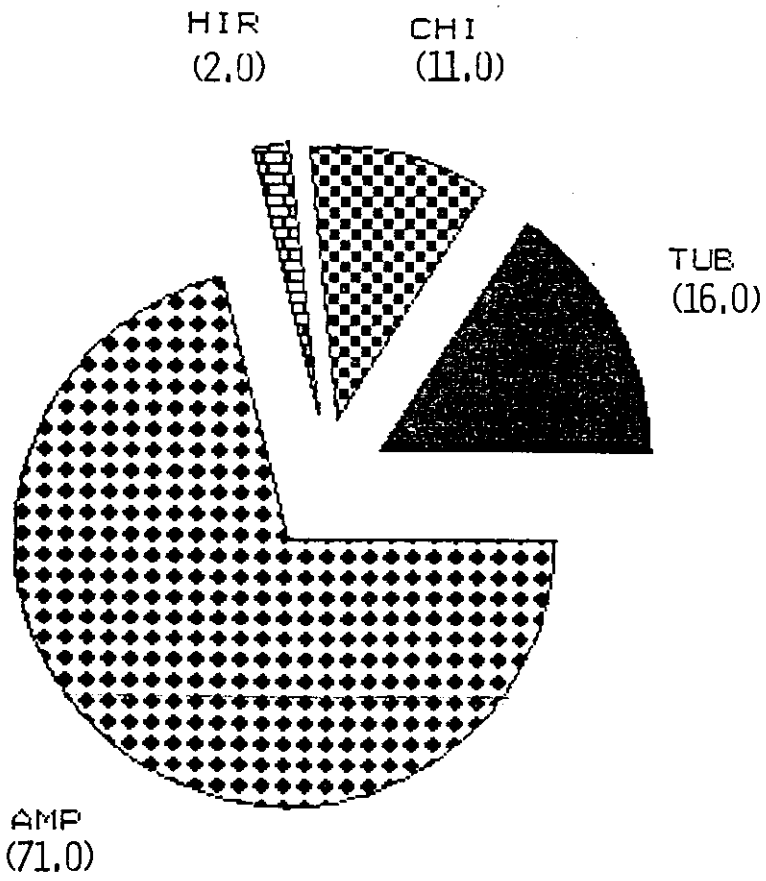
Hatchery Creek Spawning Run

The 1985 spawning run of cutthroat trout into the Hatchery Creek spawnhouse was controlled at about 6,000 fish. The estimated total spawning run, including those not allowed access into the fish ladder and those transported to Targhee Creek, equaled or exceeded the 1984 run. It is apparent from the substantial spawning runs of 1984 and 1985 that the bolstered stocking strategy implemented since 1980 has increased densities of adult cutthroat.

The mean size of both male and female cutthroat trout spawners declined in 1985 as compared to previous years. It is not apparent whether this size decrease is directly attributable to an actual density-related variable or to the general lack of age IV and older fish in the spawning run. It is suspected that the size decrease is a function of the run being comprised primarily of two- and three-year-old fish.

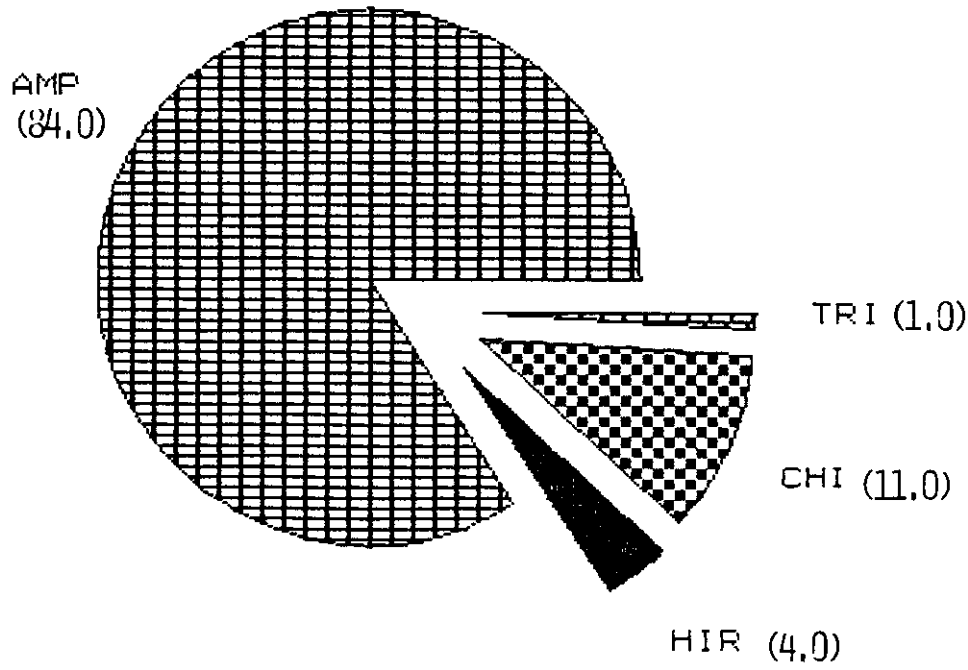
The 1985 hybrid trout spawning run was only 40% of the 1984 run. This may be an artificial comparison since thousands of trout were prevented from entering the ladder. The size of both male and female hybrid trout declined in the 1985 spawning run as compared with 1984. The majority of the spring spawning run of hybrids appeared to be comprised of two- and three-year-old fish.

The 1985 cutthroat trout egg take at Henrys Lake was 11% less than that collected in 1984. This was due to a lack of demand from other management programs.



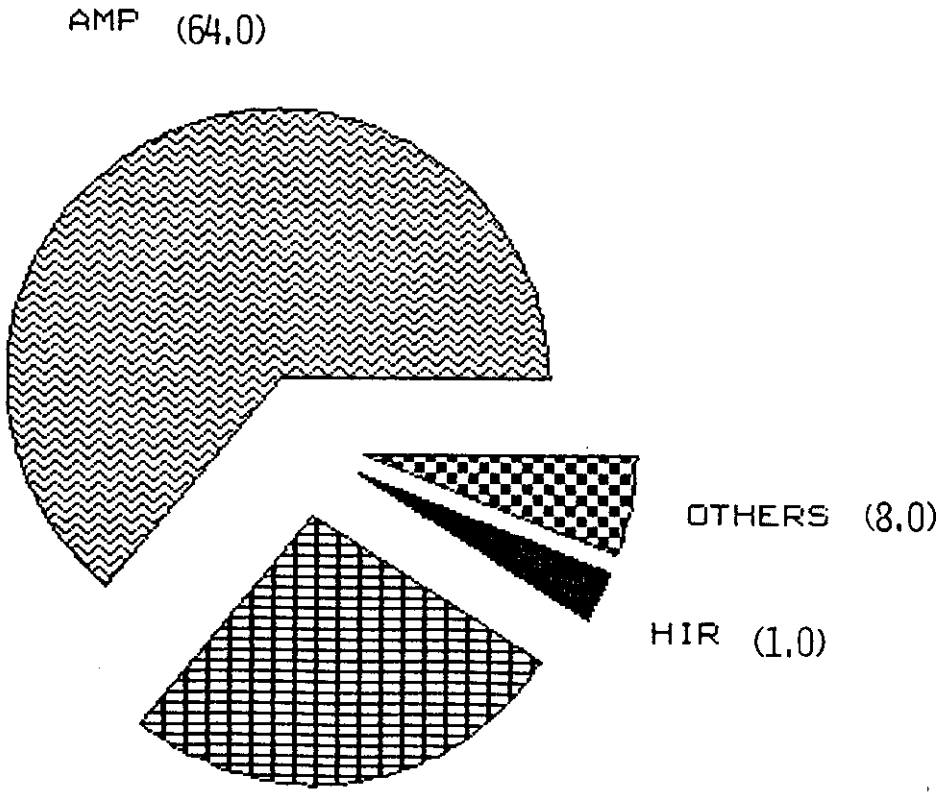
STALEY SPRINGS HARBOR

Figure 8. Pie chart illustrating the species composition of benthic invertebrates from one Ponar Grab sample collected near Staley Springs Harbor on August 23, 1985. Percentages are in parentheses. AMP = Amphipoda, HIR = Hirudinea, CHI = Chironomidae, TUB = Tubificidae.



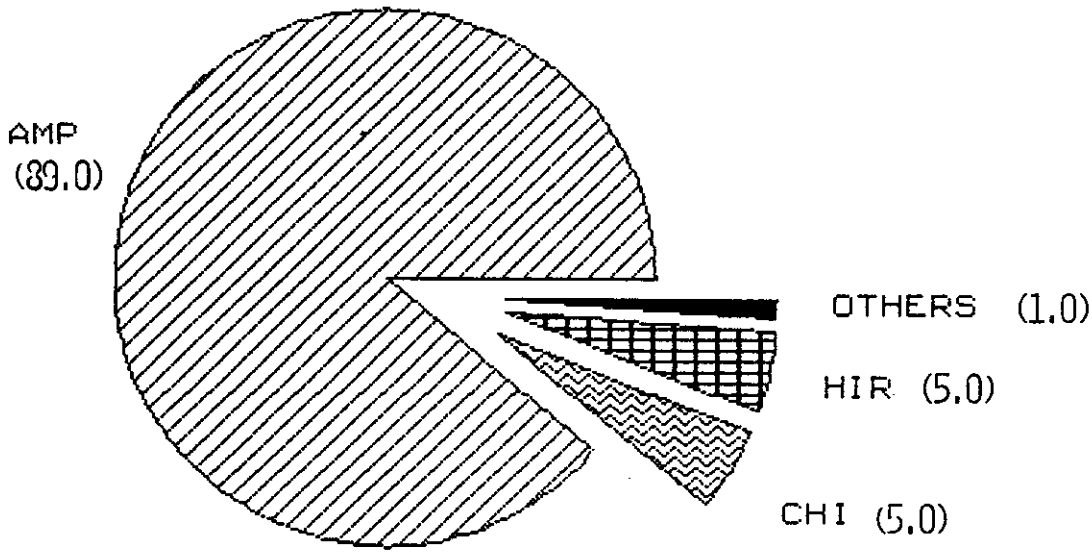
DUCK CREEK

Figure 9. Pie chart illustrating the species composition of benthic invertebrates from one Ponar Grab sample collected near the mouth of Duck Creek on August 23, 1985. AMP = Amphipoda, HIR = Hirudinea, CHI = Chironomidae, TRI = Trichoptera.



TARGHEE CREEK

Figure 10. Pie chart illustrating the species composition of benthic invertebrates from one Ponar Grab sample collected near the mouth of Targhee Creek on August 23, 1985. AMP = Amphipoda, CHI = Chironomidae, HIR = Hirudinea, OTHERS = Pelecypoda, Trichoptera, Tubificidae, and Ephemeroptera.



SCHOOL HOUSE CANYON

Figure 11. Pie chart illustrating the species composition of benthic invertebrates from one Ponar Grab sample collected near School House Canyon on August 23, 1985. AMP = Amphipoda, CHI = Chironomidae, HIR = Hirudinea, OTHERS = Odonata, Tubificidae, and Pelecypoda.

The average eye-up for cutthroat trout eggs in 1985 (86%) was less than the 1984 average of 95%. This is attributable to batches of overripe eggs being taken from trout which were probably held in the spawnhouse for too long, or from later takes of eggs exhibiting soft-shell (L. Watson, Idaho Dept. of Fish and Game, personal communication) . It is advisable to let only as many spawning fish into the ladder as can be reasonably processed in one day.

The Hatchery Creek fish ladder was kept open through November 1985, yet no brook trout ascended Hatchery Creek. Several reasons may account for this. First, survival of the 1980, 1981, and 1982 cohorts (released in the fall of 1981, 1982, and 1983, respectively) may have been poor. The 1981 and 1982 cohorts were released via Hatchery Creek (Rohrer 1983; Cole 1984); however, the 1980 cohort was released near the county boat ramp (Rohrer 1982) and were not imprinted to the fish ladder. Only about 22,000 or less of the Canadian strain brook trout were stocked during the fall of 1981 through 1983. These numbers, coupled with high post-stocking mortality, may not be adequate to induce a self-sustaining population of Canadian brook trout in Henrys Lake. The 1986 brook trout spawning run will probably be negligible. Due to a lack of eggs from Cornell University in 1983, no 1984 release occurred. Second, few naturalized brook trout have been recorded in the spawning run at Hatchery Creek since 1979, while adequate runs exist in other tributaries (L. Watson, IDFG, personal communication). I n 1984, nearly 90% of the brook trout spawning run to Hatchery Creek was comprised of Canadian strain fish (total run of 91 fish). Third, selective harvest of an already depressed brook trout population may have led to a substantial depletion of available spawners.

A program should be established to capture spawning brook trout with trap nets near tributary mouths in late October to early November before the lake freezes over. Captured fish could be held in the spawnhouse until ripe. This egg source would ensure the availability of brook trout for annual stocking in Henrys Lake if fish are not available from New York. This program should Include separate egg takes of both naturalized and Canadian strain fish (Temiscamie) until further evaluation is conducted on the performance of Canadian brook trout.

Sport Fishery

Angler Effort and Catch Rate

Anglers again experienced exceptional fishing success at Henrys Lake in 1985. The overall catch rate of nearly 1.3 trout/hr. was down somewhat from the 1984 season catch rate of almost 1.7 trout/hr.; however, it was nearly twice the goal of 0.7 trout/hr. proposed in the Henrys Lake Enhancement Plan. The goal for the catch rate was changed to 1.0 fish/hr. by the Idaho Fish and Game Commission in 1985.

Angler effort at Henrys Lake in 1985 was 23% lower than observed in 1984. Island Park Reservoir was drawn down for dam repairs during the peak of the fishing season in 1984. Anglers who would have normally fished at Island Park Reservoir were diverted instead to Henrys Lake which is located a short distance away. Second, anglers enjoyed exceptional fishing at Henrys Lake in 1984, consequently, more anglers were drawn there than to other Island Park waters.

Cutthroat trout supported the fishery at Henrys Lake in 1985. Hybrid trout and brook trout returned to the creel at considerably lower rates than proposed in the Fishery Management Plan. Increased stocking levels of brook trout and hybrids from 1985 on should act to bring composition of the catch closer to levels called for in the 1982 Fishery Management Plan.

Trout Harvest

Cutthroat trout comprised 92% of the 1985 catch (total harvest plus release) at Henrys Lake, while brook trout and hybrid trout comprised only 4%, each, of the catch. The Management Plan for Henrys Lake specifies a species catch rate of 0.65 cutthroat trout/hr., 0.20 hybrid trout/hr., and 0.15 brook trout/hr. Stocking rates of hybrid trout and brook trout need to be maintained at high levels as in 1985 if these goals are to be obtained.

The mean total length of cutthroat trout in the creel in 1985 (378 mm) was lower than the 1984 mean (388 mm) and all subsequent years back to 1976. However, 92% of the total number of cutthroat trout measured in 1985 creel interviews were checked prior to early August, thus, at least two months remained in the growing season. Cutthroat trout measured after the sixth census interval (August 3 to August 16) averaged greater than 388 mm total length. The majority of the catch appeared to be comprised of two- and three-year-old fish as suggested by scale analysis. No trophy-sized (>510 mm) cutthroat trout were observed in the 1985 harvest, suggesting low numbers of four- and five-year-old fish.

The mean total length of brook trout observed in the 1985 harvest (364 mm) was well below the mean length reported in the 1984 fishery (393 mm); however, most of these fish were measured during the first half of the creel survey and had growth yet to attain.

Nearly equivalent numbers of brook trout were estimated to have been harvested in 1984 and 1985. However, no Canadian brook trout (Temiscamie and Assinica) were observed in the creel during 1985. In 1983 and 1984, approximately 32% and 24%, respectively, of the brook trout harvest was comprised of Canadian strain brook trout. Naturalized brook trout have consistently been caught in substantially higher numbers than other brook trout strains. It is not apparent whether this is due simply to greater numbers of naturalized fish in the lake or to Canadian strain fish being less vulnerable to harvest than the naturalized population of brook trout. No brook trout of

trophy size (>450 mm) were seen in the harvest in 1985 as opposed to 13% in 1984. The Enhancement Plan calls for a 5% goal of trophy length brook trout in the harvest.

The mean size of hybrid trout observed in the 1985 creel survey (416 mm) was comparable to the 1984 mean length (427 mm). Again, most hybrids measured in creel checks were observed early in the season. The drastic decrease in the number of hybrids harvested is probably due to low stocking rates and smaller size of hybrid fingerlings released in years prior to 1985.

Population Sampling

Trap Netting

Cutthroat trout continue to be the predominant fish species present in Henrys Lake as suggested by population sampling with nets and their abundance in the fishery. Species composition of Henrys Lake was similar when comparing data collected from nets and the creel survey. However, brook trout were four times more abundant in nets than in the fishery. This is probably attributable to net sampling spwning runs of brook trout. Trap nets proved to be an effective means for capturing salmonids in Henrys Lake during the fall. However, an effective method for sampling trout less than 250 mm total length needs to be incorporated into the sampling program. Scale samples from age I+ cutthroat trout were noticeably lacking from age and growth analysis. Electrofishing from a boat along selected shoreline areas may be a more productive method to sample smaller fish. Shoreline seining might also be utilized.

Scale Analysis

Scale analysis performed in 1985 does not indicate a continuing decline in growth rate of the cutthroat trout population in Henrys Lake. Rather, growth declines appear to have tapered off as indicated by back-calculated lengths at annuli formation. The back-calculated total length at annulus I was similar to that reported by Greider (1986); however, back-calculated lengths at annuli II and III were higher than those reported in the 1984 analysis. A weak point in the 1985 analysis was the general lack of age I+ cutthroat trout scales in the sample. Though the coefficient of determination for the body: scale regression was low (r^2=0.40), indicating a poor fit between variables, no attempt was made to modify the direct proportion formula. Thus, an adjustment to the formula probably is warranted.

Age and growth assessment from scales collected from Henrys Lake cutthroat trout was confounded by the presence of false annuli on a substantial number of scales in the sample. Spateholts (1984) reported false annuli occurring on brook trout scales collected from Henrys Lake

fish. He suggested that growth checks were related to thermal stress. The occurrence of false annuli on cutthroat trout scales made analysis difficult. The general lack of clearly distinct annuli coupled with the presence of summer growth checks possibly resul ted in a somewhat conjectural scale analysis. Several more seasons of age-growth data need to be collected from the cutthroat trout population in Henrys Lake before accurate trends in growth can be assessed. Data reported in 1977 (Coon 1978b) and 1983 (Cole 1984) are somewhat tentative due to small sample sizes (n=32 and 56, respectively) which may not accurately reflect growth among all size and age groups.

The use of a 25 mm correction factor (from Irving 1953) should be standardized when performing back-calculations of growth for the cutthroat trout population of Henrys Lake until the approximate size at squamation can be determined. Irving calculated this correction factor when determining the body:scale regression equation for Henrys Lake cutthroat trout. This would aid in consistency when making comparisons of growth between years. The approximate size of cutthroat trout fry when squamation occurs could be assessed from specimens collected while trapping tributary streams.

Tributary Evaluations

Spawning Activity

Howard Creek Slough. The lower reach of Howard Creek has the potential to produce a good spawning run of salmonids. Although spawning cutthroat trout were observed in the slough, suitable spawning habitat is scarce due to a substantial sediment load. Pools and undercut banks are abundant. Stream improvement structures constructed to scour sediment from the substrate would be beneficial.

Kelly Creek. Habitat for spawning, rearing, and cover for salmonids in Kelly Creek ranges from poor to fair condition. Overgrazing has resulted In collapsed stream banks, removal of riparian vegetation, a widening of the stream channel, and a substanti al sediment load. Many former deep pools have filled in substantially with sediment. Most willows (Sal ix spp.) appear to have been poisoned.

All available suitable-size gravel was well utilized by spawning cutthroat trout. Overlapping of redds was common. In the early 1950s, Kelly Creek supported about 5% of the cutthroat trout spawning run (Andriano 1956). To improve spawning habitat in Kelly Creek, Department personnel should work with landowners to fence critical riparian areas. Habitat improvement structures aimed at scouring sediment from gravel should be considered if feasible. Another viable alternative is to utilize recently developed gravel-cleaning machinery used to rehabilitate salmonid spawning habitat (Grunder 1985).

Gillan Creek. Habitat enhancement is not a viable option in Gillan Creek. Since the major earthquake centered near Borah Peak occurred in October 1983, flows In Gillan Creek have significantly decreased (L. Webster, rancher, personal communication). The stream is essentially ephemeral in nature since this event and cannot support a fish population year-round. The stream is utilized in the spring by spawning cutthroat trout; however, low water and high water temperatures (>20 C) probably limit emergent fry survival.

South Fork Duck Creek. Most of the South Fork of Duck Creek is situated on National Forest land which is subjected to grazing by domestic cattle. The riparian habitat is in fair to good condition; however, grazing has caused typical problems such as loss of streambank cover and sedimentation. Spawning gravel is abundant, yet no trout redds were observed at any point in the stream. The numerous barriers present in the South Fork probably eliminates passage upstream by spawning fish. If spawning fish were successful in negotiating the barriers, it is unlikely that fry or fingerlings could migrate downstream into Henrys Lake because of water diversions resulting in the lack of water in sections of Duck Creek during critical movement periods.

Any rehabilitative efforts undertaken on the South Fork of Duck Creek should be undertaken to coincide with efforts directed to enhance fish habitat in Duck Creek proper.

Fry Observations

In early August 1985, cutthroat trout fry were observed in all tributaries of Henrys Lake except Gillan Creek, which was dry. The extent of natural recruitment from tributaries is currently limited by water diversions, lack of water in certain stream reaches, impassable road culverts, and sedimentation.

Rearing areas in several degraded tributaries of Henrys Lake (Kelly, Duck, and Hope creeks) are generally lacking. Areas of slow, shallow water preferred by cutthroat trout fry (Miller 1957; Horner and BJornn 1976) are abundant. However, cover in the form of aquatic vegetation, debris piles, and the interstitial spaces between rocks is not abundant and may lead to decreased fry survival.

Winter cover in the form of rubble (10 to 40 cm diameter) is not typically present in Henrys Lake tributaries except for Targhee Creek. The use of smaller diameter rocks for winter cover may result in increased mortality due to shifting of the substrate (Bustard and Narver 1975). Cutthroat trout fry overwintering in tributaries of Henrys Lake may be faced with adverse conditions due to the general lack of suitable habitat.

Fry Trapping

Mortality of cutthroat trout in Kelly Creek from the egg to hatching stages appears to be substantial and warrants concern. Efficiency of the Kray-Meekin fry trap, although not directly measured, was thought to be high due to continual maintenance and success in diverting all flow through the trap. A total of only 1,009 cutthroat trout fry were actually captured. Considering the 324 identifiable redds observed in May in only a section of Kelly Creek, and the average egg production per female fish seen in the 1985 hatchery run (2, 050), mortality currently appears to severely limit natural production of cutthroat trout in Kelly Creek. The percent egg to downstream migrant survival for adfiuvial cutthroat trout populations reported in the literature ranges from 0.04 to 12.2 (Hayden 1967; Ball and Cope 1961; Snyder and Tanner 1960; Moore 1980; Moore and Schill 1984). Survival of cutthroat trout young-of-the-year in Kelly Creek is presumed to be low due to grazing practices that impact the stream. Recruitment potential of 100,000 cutthroat trout fry from Kelly Creek into Henrys Lake as displayed in the Enhancement Plan will not be possible unless condition of the habitat is improved.

To what extent cutthroat trout fry overwinter in tributaries of Henrys Lake is unknown. If substantial numbers of young-of-the-year remained in Kelly Creek following removal of the fry trap, then downstream migrant numbers would be underestimated. Fry of lake resident fish may either move into the lake from natal streams during the first year or overwinter in the spawning stream and move into the lake during subsequent growing seasons (Raleigh 1971; Raleigh and Chapman 1971). However, because of the relatively poor condition of overwintering habitat in Kelly Creek, It is unlikely many fry or fingerlings remain in the stream past the first growing season.

The degraded condition of Kelly Creek is due entirely to grazing practices. The entire length of Kelly Creek is located on private land, none of which is fenced except perpendicular to the stream channel to create separate pastures. Cattle are introduced onto the area prior to emergence of fry from the gravel. Cutthroat trout fry typically remain in the gravel for about two weeks after hatching (Scott and Crossman 1973) and emerge 45 to 75 days after egg fertilization depending on water temperature (Calhoun 1944; Lea 1960). During the latter part of this critical period, grazing pressure on land adjacent to Kelly Creek is extensive leading to physical trampling of redds and sedimentation. Mortality of cutthroat trout fry at this time is suspected to be substantial. Kelly Creek supported 5% of the cutthroat trout spawning run in 1954 and 1955 (Andriano 1956). Local landowners appear amenable to fencing critical riparian areas of Kelly Creek.

Stocking Programs

The numbers of cutthroat trout fry and fingerlings stocked into Henrys Lake in 1985 (n=1,003,030) represented a 50% decrease in numbers planted annually since 1981. This strategy was implemented to offset possible growth declines due to increasing population size. Age and growth analysis of cutthroat trout should be performed annually to monitor this variable. Until a dependable estimate of natural recruitment from tributaries is attained, the fishery will need to be supplemented annually with at least the current level of cutthroat trout.

The program of stocking Canadian strain brook trout in Henrys Lake needs ongoing evaluation. Currently, these fish do not provide the harvest level and trophy fishery intended when the program was initiated. This is probably due to the relatively low stocking levels. In addition to eggs purchased from New York, a program to gather eggs from spawning fish should be implemented.This could be done with brook trout returning to Hatchery Creek and by capturing fish with trap nets prior to the lake freezing over. Since Temiscamie and Assinica brook trout display superior growth potential over naturalized
stocks in Henrys Lake (Spateholts 1984), the potential for an
exceptional trophy fishery exists with an expansion of the program.

The stocking level of hybrid trout increased by over two-fold in 1985 compared to 1984. These stocking rates (300,000 fish) need to be maintained to meet objectives proposed In the Henrys Lake Enhancement Plan.

Sterile Hybrid Experiments

Continuing research to produce triploid salmonids at the Henrys Lake Hatchery has shown that sterile hybrids can be mass produced effectively. Surplus cutthroat trout eggs collected during the Hatchery Creek spawning run should be utilized in sterile hybrid experiments. To produce sterile hybrids, both heat treatment and hormonal treatment should be used to assess which technique is most effective.Treated lots of sterile hybrids should be tested to determine gonadal development.

All cutthroat trout x rainbow trout hybrids should be stocked in Hatchery Creek to imprint them upon this location. This procedure would facilitate data collection upon return of the mature hybrids to spawn.

Benthic Macro invertebrates

Amphipods were the major taxon present in benthic samples from Henrys Lake in late August 1985. Irving (1953) found dipteran larvae to be the most abundant taxon present in Ekman dredge samples from Henrys Lake taken in August 1951. Amphipods comprised only an average of 17% of total numbers of Irving's samples. If these samples are comparable (34 years separate), then amphipods are now apparently more abundant in Henrys Lake than in the past. This may be due to an increased biomass of hydrophytes or to organic enrichment of the sediment. Gammarus and Hyalella, amphipods which are present in Henrys Lake (Spateholts 1984), both utilize as food epiphytes present on macrophytes and algae present on sediments.

Comparing the August benthic samples of Irving (1953) and the present study, 1985 samples revealed an average of approximately 1,183 organisms/m^2 while samples from 1951 possessed a mean of 1,883 organisms/m^2. This suggests a possible decline in benthic fauna abundance; however, results are tenuous until further, more intensive sampling is performed.

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A P P E N D I C E S

5 3

Appendix 1. Estimated fishing effort, harvest, and catch rates of boat anglers at Henrys Lake, 1985.

Census interval	Angler hours	Trout harvested			Total	Trout released	Total trout/hr.
		Cutthroat	Brook	Hybrid			1.26
05/25-06/07	10,200	3,468	102	102	3,672	9,180	
06/08-06/21	15,450	7,107	154	108	7,369	29,355	2.40
06/22-07/05	19,846	5,556	0	794	6,350	8,534	0.74
07/06-07/19	20,675	6,202	414	206	6,822	4,135	0.52
07/20-08/02	5,126	871	20	102	993	4,306	1.03
08/03-08/16	3,744	524	0	0	524	10,483	2.94
08/17-08/30	4,842	484	96	38	618	4,842	1.12
08/31-09/13	6,468	2,458	0	0	2,458	9,055	1.78
09/14-09/27	7,865	1,573	157	157	1,887	17,303	2.44
09/28-10/11	2,397	1,294	0	48	1,342	2,924	1.78
10/12-10/31	4,000	1,800	12	12	1,824	2,120	0.98
TOTALS	100,613	31,337	955	1,567	33,859	102,237	1.35

Appendix 2. Estimated fishing effort, harvest, and catch rates of bank anglers at Henrys Lake, 1985.

Census interval	Angler hours	Trout harvested			Total	Trout released	Total trout/hr.
		Cutthroat	Brook	Hybrid			
05/25-06/07	2,080	374	20	0	394	1,310	0.82
06/08-06/21	2,616	444	52	0	496	994	0.56
06/22-07/05	3,170	412	0	0	412	0	0.12
07/06-07/19	960	0	0	0	0	0	0.00[a]
07/20-08/02	320	0	0	0	0	0	0.00[b]
08/03-08/16	1,507	0	0	0	0	0	0.00[c]
08/17-08/30	1,814	689	362	0	1,051	0	0.58
08/31-09/13	690	NO INTERVIEWS					
09/14-09/27	503	NO INTERVIEWS					
09/28-10/11	421	218	0	0	218	0	0.52
10/12-10/31	1,733	988	34	0	1,022	69	0.63
TOTALS	15,814	3,125	468	0	3,593	2,373	0.34

[a]Only 15.0 hours of interviews tabulated.

[b]Only 5.5 hours of interviews tabulated.

[c]Only 5.0 hours of interviews tabulated.

Appendix 3. Estimated fishing effort, harvest, and catch rates of tube anglers at Henrys Lake, 1985.

Census interval	Angler hours	Trout harvested				Trout released	Total trout/hr.
		Cutthroat	Brook	Hybrid	Total		
05/25-06/07	436	148	0	26	174	628	1.84
06/08-06/21	1,212	48	0	0	48	2,036	1.72
06/22-07/05	2,224	0	0	0	0	2,535	1.14
07/06-07/19	1,850	56	0	0	56	2,812	1.55
07/20-08/02	570	0	0	0	0	0	0.00[a]
08/03-08/16	534	0	0	0	0	3,044	5.70[b]
08/17-08/30	806	0	0	0	0	3,288	4.08[c]
08/31-09/13	716	28	0	0	28	644	0.94
09/14-09/27	734	184	0	0	184	1,174	1.85
09/28-10/11	172	17	0	0	17	275	1.70
10/12-10/31	75	0	0	0	0	225	3.00[d]
TOTALS	9,329	481	0	26	507	16,661	1.84

[a]Only 3.0 hours of interviews tabulated.

[b]Only 10.0 hours of interviews tabulated

.[c]Only 10.5 hours of interviews tabulated.

[d]Only 4.0 hours of interviews tabulated.

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